

U.S.S.N. 08/786,988

LITTLE, et al.

AMENDMENT AFTER FINAL

moving said vesicle to each of a set of positions adjacent to the surface of the substrate, whereby a defined and controlled sub to low nanoliter volume of fluid is dispensed at each location of said set forming an array of spots of sample material on the substrate such that spot-to-spot characteristics are reproducible in the array; and

performing mass spectrometry analysis of the sample material at each location of the array.

5. (Twice Amended) A method for forming an array of a sample material on a surface of a substrate and analyzing the sample material in the resulting array, comprising:

providing a vesicle that has an interior chamber containing a fluid comprising a solvent containing material for deposition;

disposing said vesicle adjacent to a first location on said surface of the substrate without contacting the surface with the vesicle;

providing mechanical pressure to the interior of the vesicle to eject from said chamber a defined and controlled 0.2 to 20 nanoliter volume of the fluid to dispense solvent containing matrix material at said first location of said surface of the substrate, wherein the matrix material is for matrix-assisted laser desorption mass spectrometry;

waiting a predetermined period of time to allow the solvent containing the matrix material to evaporate on the surface of the substrate thereby depositing the matrix material on the surface;

moving said vesicle to each of a set of positions adjacent to the surface of the substrate, whereby a defined and controlled 0.2 to 20 nanoliter volume of fluid is dispensed at each location of said set forming an array of spots of matrix material on the substrate; and

ejecting a nanoliter volume of fluid containing an analyte material onto said evaporated matrix material at each locus of the array to dissolve with said matrix

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material and to form a crystalline structure on at each locus of the substrate surface such that spot-to-spot characteristics are reproducible in the array; performing mass spectrometry analysis of the sample material at each location of the array.

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25. (Amended four times) A method for analyzing a material, comprising:
providing a vesicle comprising a fluid containing the material in a solvent;
disposing said vesicle adjacent to a first location of a surface of a substrate without contacting the surface with the vesicle;
delivering a defined and controlled nanoliter volume of the fluid at the first location of said surface of the substrate;
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moving said vesicle to a second position next to the first location on said surface of the substrate to dispense a defined and controlled [sub to low] nanoliter volume of said material along an array of locations on said substrate surface to form an array of the material such that spot-to-spot characteristics are reproducible in the array; and
performing mass spectrometry analysis for said material at each location of said array.

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31. (Thrice Amended) A system for forming an array of a sample material on a surface of a substrate and analyzing the sample material in the array, comprising:
a vesicle having a distal end suitable for carrying a nanoliter of fluid;
a movable arm having a distal portion mounted to move said vesicle;
a controller for moving said arm to dispose said vesicle adjacent to a first location on said surface of the substrate and for controlling said vesicle to deliver a defined and controlled 0.2 to 20 nanoliter volume of the fluid at said first location of said surface of the substrate; and
a mass spectrometer for analyzing said material deposited on said surface of said substrate.

40. (Thrice Amended) A method for dispensing sub to low nanoliter volumes of a material as an array onto the surface of a substrate, comprising the steps of:

(a) providing an assembly having a plurality of vesicles arranged in the form of array for dispensing a liquid therefrom, wherein each vesicle has an interior chamber containing a fluid containing the material;

(b) aligning the vesicles at a first set of locations adjacent to the surface of the substrate without contacting the surface with the vesicles;

(c) using mechanical pressure, controlling each of the chambers to eject a defined and controlled 0.2 to 20 nanoliter volume of the fluid from each vesicle onto the surface of the substrate aligned with the vesicles, whereby an array spots of the fluid is deposited on the surface of the substrate, such that spot-to-spot characteristics are reproducible in the array;

(d) providing the resulting substrate with the array of material deposited thereon to a mass spectrometer and determining information representative of the composition of the deposited material.

63. A substrate of claim 40, wherein the material further comprises a nucleic acid.

64. The substrate of claim 40 that comprises a hydrophilic flat surface.

66. The substrate of claim 40 that comprises silicon.

70. (Thrice Amended) A method for dispensing nanoliter volumes of a material as an array on the surface of a substrate and analyzing the material in the array, comprising the steps of:

(a) providing a pin assembly having a plurality of elongated vesicles arranged as an array for dispensing a liquid therefrom, wherein each vesicle comprises a solid shaft of material having an end for retaining a nanoliter volume of fluid;

(b) loading a nanoliter volume of fluid comprising a liquid material from a fluid source onto the end of the vesicles of the pin assembly;